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(54) **VEHICLE BODY LOWER STRUCTURE**

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(51) **Int. Cl.**

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B60L 50/50	(2019.01)
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B62D 21/15	(2006.01)
B62D 27/06	(2006.01)

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CPC ***B62D 25/2036*** (2013.01); ***B60K 1/04*** (2013.01); ***B60L 50/50*** (2019.02); ***B62D 21/15*** (2013.01); ***B62D 25/025*** (2013.01); *B60K 2001/0438* (2013.01); *B62D 27/065* (2013.01)

(58) **Field of Classification Search**

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See application file for complete search history.

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(57) **ABSTRACT**

A vehicle body lower structure may comprise: a rocker arranged at a lower lateral part of a vehicle body and extending along a front-rear direction of the vehicle body, the rocker being hollow; a power supply package arranged under a floor panel of the vehicle body; and an energy absorbing member fixed to the power supply package and fixed to a bottom plate of the rocker. A side surface of the energy absorbing member located under the rocker may be inclined to face diagonally upward, and a drain hole may be arranged in the bottom plate at a position above the side surface.

4 Claims, 4 Drawing Sheets

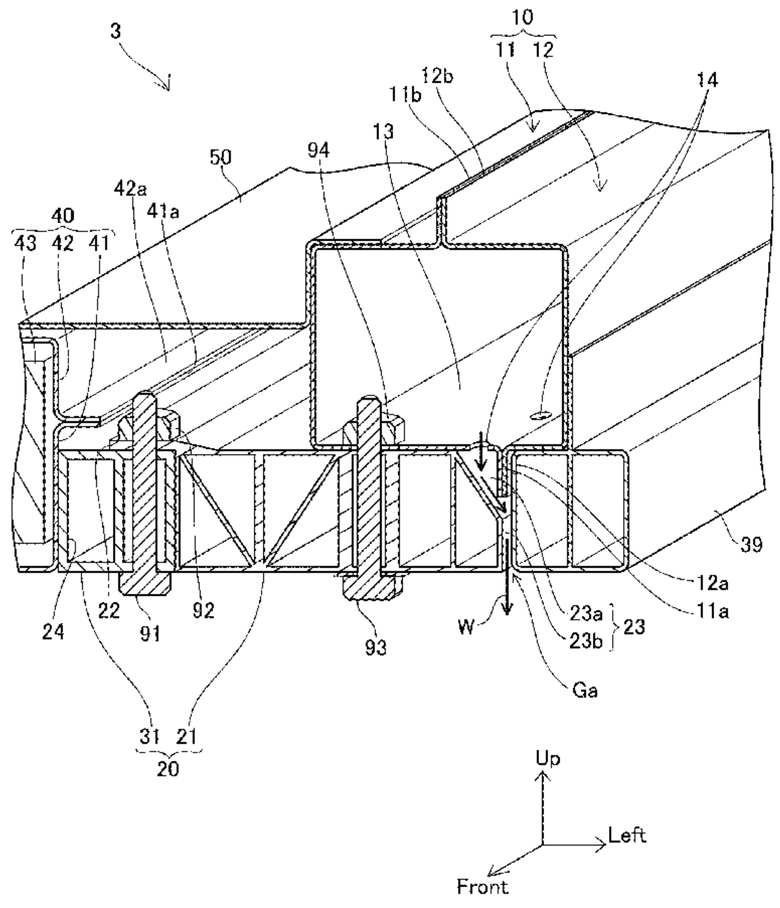

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FIG. 1

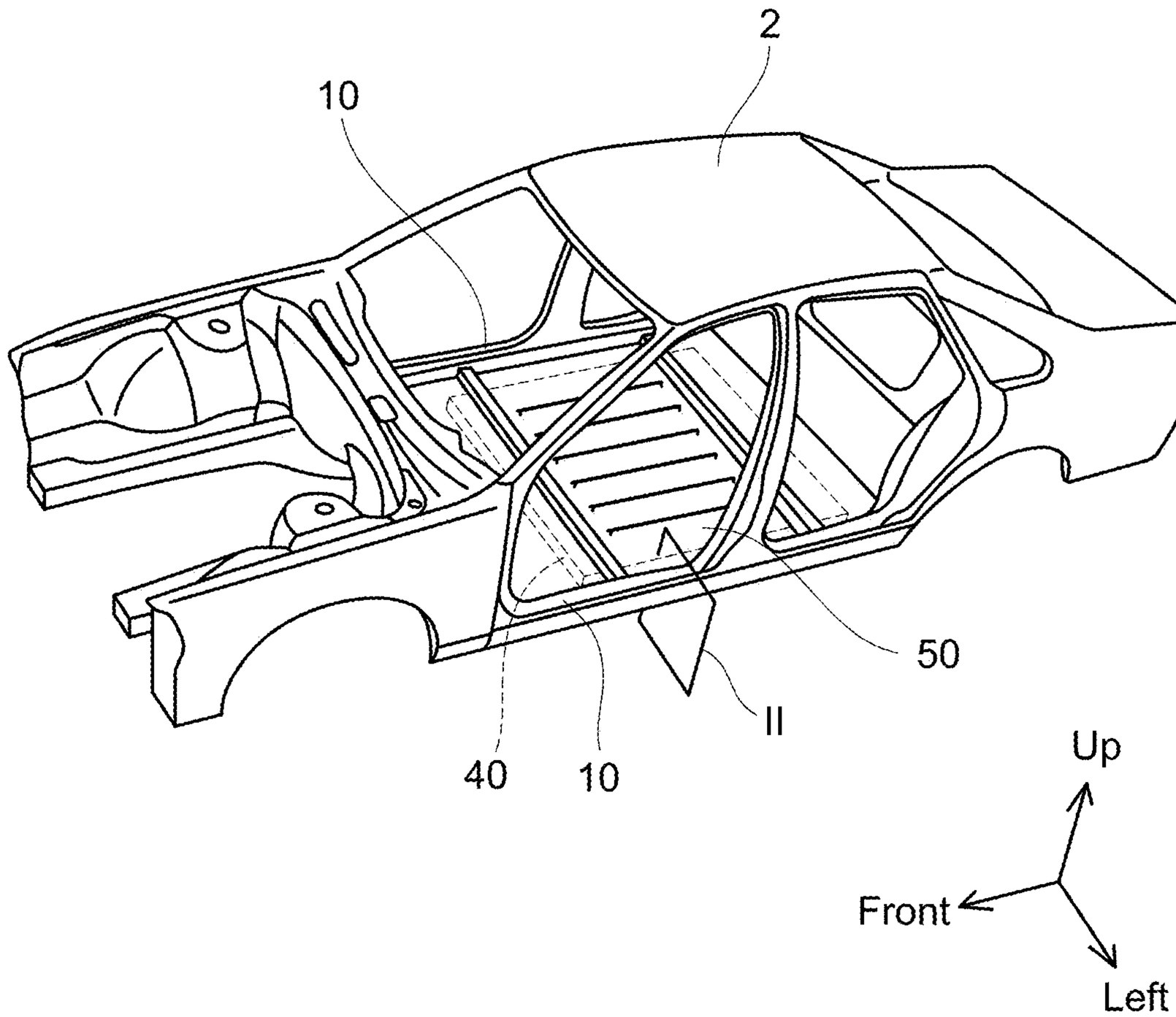


FIG. 2

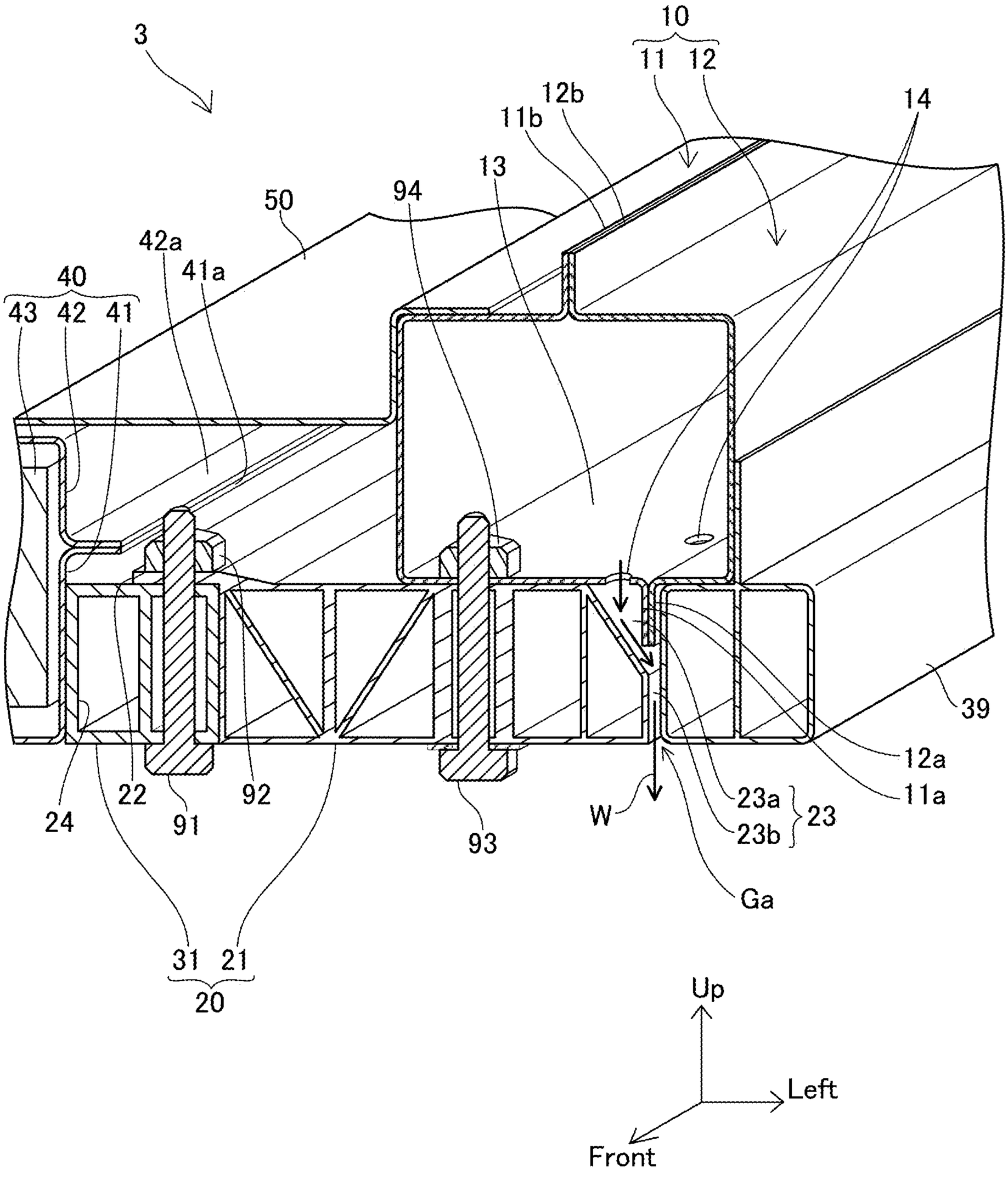
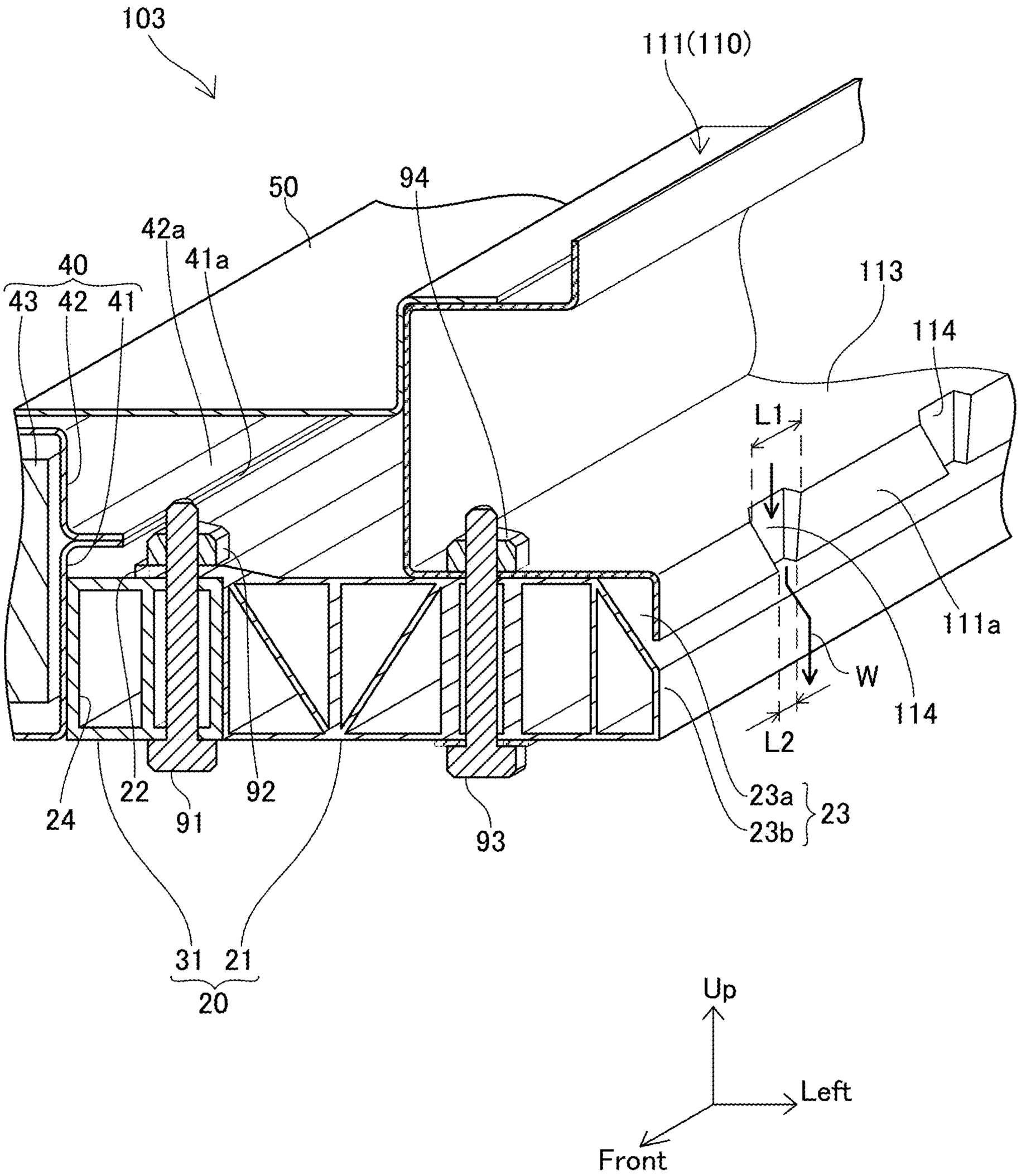

3
10
11
12
11b
12b
14
13
50
94
42a
41a
40
43
42
41
39
12a
11a
23a
23b
23
W
Ga
24
22
91
92
93
31
21
20
Up
Left
Front

FIG. 3


103
111(110)
50
94
42a
41a
40
43 42 41
113
114
L1
111a
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114
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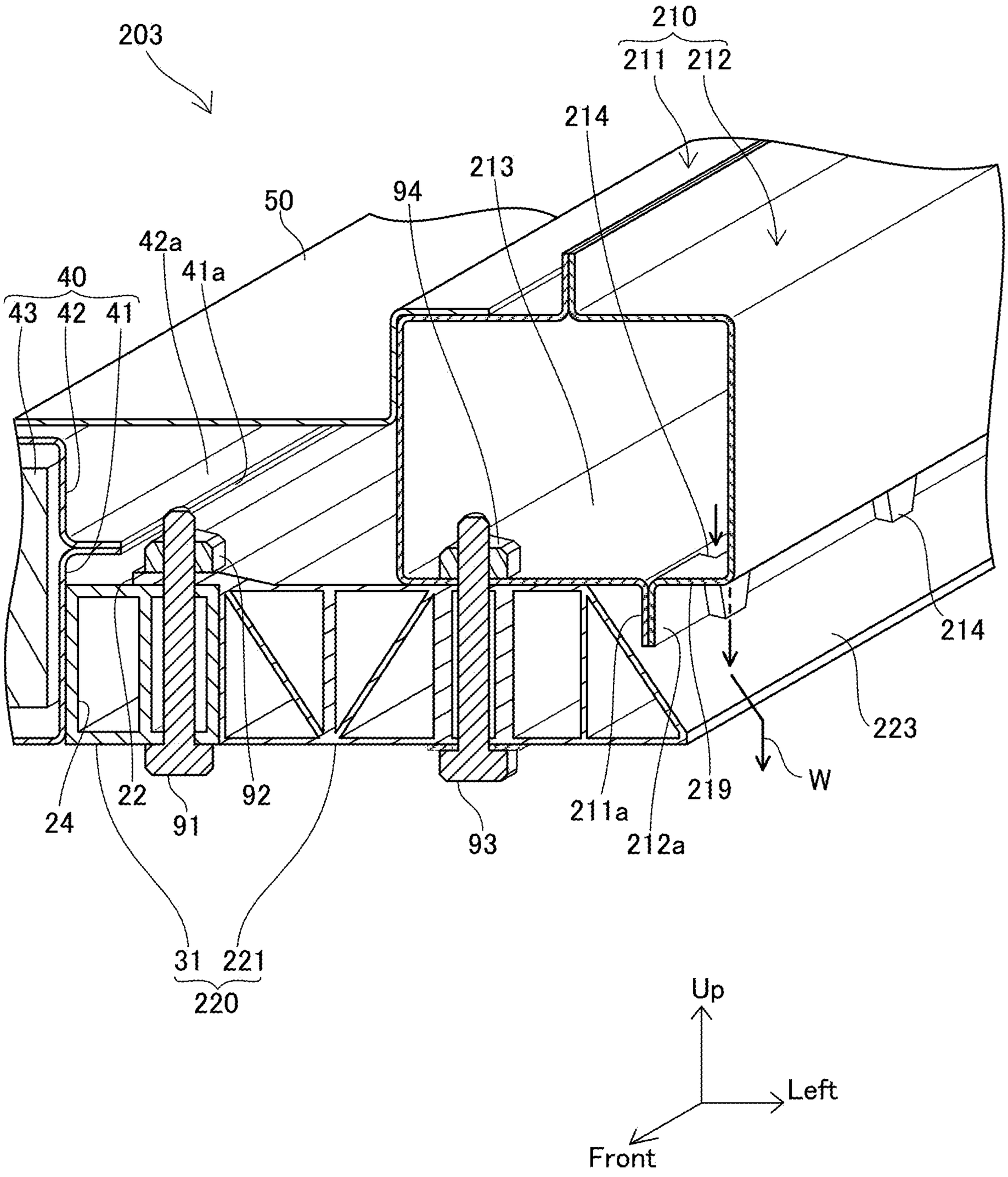
24
22
91
92
93
23a
23b
23
31 21
20
Up
Left
Front

FIG. 4


203
210
211
212
214
213
94
50
42a
41a
40
43
42
41
214
24
22
91
92
93
211a
212a
219
W
223
31
221
220
Up
Left
Front

VEHICLE BODY LOWER STRUCTURE

CROSS-REFERENCE TO RELATED APPLICATION

This application claims priority to Japanese Patent Application No. 2019-180022 filed on Sep. 30, 2019, the contents of which are hereby incorporated by reference into the present application.

TECHNICAL FIELD

The art disclosed herein relates to a vehicle body lower structure. It relates in particular to a vehicle body lower structure in which a power supply package is disposed under a floor panel.

BACKGROUND

In some electric vehicles, a power supply package configured to supply power to a traction motor is arranged under a floor panel. The power supply package is arranged between a pair of rockers. Japanese Patent Application Publication Nos. 2018-75939 (Literature 1), 2019-6303 (Literature 2), and 2013-256265 (Literature 3) describe examples of such an electric vehicle. The pair of rockers is a frame extending along a front-rear direction of a vehicle body at lateral sides of a lower part of each vehicle body. The rockers may be sometimes referred to as "side sills". The power supply package may include a battery, a fuel cell, and the like.

In order to protect the power supply package from an impact of lateral collision from a lateral side of a vehicle body, there may be a case where a member configured to absorb impact energy (energy absorbing member) by the shock is arranged along each of the rockers. Literatures 1 and 3 describe examples of such an energy absorbing member.

In the vehicle body lower structure described in Literature 1, the power supply package is fixed to a side member. In Literature 3, the energy absorbing member is connected to the power supply package, and is fixed to a bottom plate of the rocker.

SUMMARY

The rocker is hollow, thus, water may enter inside the rocker. A consideration may be given to providing a drain hole in a bottom plate of the rocker, however, in the structure described in Literature 3, if the drain hole is provided in the bottom plate of the rocker, water will accumulate on an upper surface of the energy absorbing member. The present disclosure provides a vehicle body lower structure having a structure configured to drain water within a rocker underneath the vehicle body.

A vehicle body lower structure may comprise: a rocker arranged at a lower lateral part of a vehicle body and extending along a front-rear direction of the vehicle body, the rocker being hollow; a power supply package arranged under a floor panel of the vehicle body; and an energy absorbing member fixed to the power supply package and fixed to a bottom plate of the rocker. A side surface of the energy absorbing member located under the rocker may be inclined to face diagonally upward, and a drain hole may be arranged in the bottom plate at a position above the side surface.

To simplify the description, the side surface of the energy absorbing member that is inclined will be referred to as an inclined side surface. In the vehicle body lower structure disclosed herein, the drain hole is provided in the bottom plate of the rocker, and the inclined side surface of the energy absorbing member is located under the drain hole. Water that flowed down through the drain hole flows along the inclined side surface and is drained underneath the vehicle body. The water that has been drained from the drain hole of the rocker does not remain on the energy absorbing member. The side surface of the energy absorbing member may be inclined at least at an upper side of the side surface, and a lower side of the side surface may be oriented along a horizontal direction.

The rocker may comprise a rocker inner panel and a rocker outer panel. The rocker inner panel may be located on a center side of the vehicle body in the vehicle-width direction. The rocker outer panel may be adjacent to the rocker inner panel, and may be located outside of the inner rocker panel in the vehicle-width direction. Each of the rocker inner panel and the rocker outer panel may comprise a flange extending downward, and the flange of the rocker inner panel and the flange of the rocker outer panel may face each other. The rocker inner panel and the rocker outer panel may have their respective flanges joined to each other. In such a structure, at least one of the flanges of the rocker inner panel and the rocker outer panel may comprise a groove as a drain hole. The groove may penetrate from an upper end to a lower end of the flange. When the rocker inner panel and the rocker outer panel are joined to each other, the groove of the one flange and the other flange facing the groove may constitute a hole (drain hole). Since the drain hole that is vertically elongated is constituted by the groove, water may not enter into the rocker from below through the drain hole.

The width of the groove may be narrowed toward a lower side. The possibility of water through the drain hole from below into the rocker may be further reduced.

Details and further developments of the art disclosed herein will be described in DETAILED DESCRIPTION as below.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** illustrates a perspective view of a vehicle body.

FIG. **2** illustrates a cross-sectional view of the vehicle body taken along a plane II of FIG. **1**.

FIG. **3** illustrates a cross-sectional view showing a vehicle body lower structure according to a second embodiment.

FIG. **4** illustrates a cross-sectional view showing a vehicle body lower structure according to a third embodiment.

DETAILED DESCRIPTION

Embodiment

A vehicle body lower structure **3** according to an embodiment will be described with reference to the drawings. FIG. **1** illustrates a perspective view of a vehicle body **2**. "Left" in a coordinate system of FIG. **1** indicates "left" in a case of seeing a front side from a rear side of the vehicle body. The "Left" in the coordinate system has a like meaning in all of the drawings.

The vehicle body **2** comprises a pair of rockers **10**. Each of the rockers **10** is arranged at a corresponding lateral side of a lower part of the vehicle body **2** in a vehicle-width (left-right) direction of the vehicle body **2**. Each rocker **10** is hollow, has an elongated shape, and extends along a

front-rear direction of the vehicle body. The pair of rockers **10** is one type of frames configured to secure rigidity of the vehicle body. The rockers **10** are made by extrusion molding of a metal (typically, aluminum).

A power supply package **40** and a floor panel **50** are arranged between the pair of rockers **10**. The power supply package **40** incorporates a large number of battery cells therein. The battery cells are connected in series, and configured to output high-voltage power. The power supply package **40** is configured to supply the power to a traction motor (not shown). The power supply package **40** may be a collective body of fuel cells.

The floor panel **50** corresponds to a floor of a cabin. Each side of the floor panel **50** is fixed to corresponding one of the rockers **10**. The power supply package **40** is arranged under the floor panel **50**. Although details will be described later, an energy absorbing member (not shown in FIG. **1**) is arranged along the rockers **10**, and the power supply package **40** is supported by the pair of rockers **10** via the energy absorbing member. Hereafter, the energy absorbing member will be referred to as an EA member (Energy Absorbing member) for convenience of description.

FIG. **2** shows a cross section of the vehicle body **2** cut along a plane **11** of FIG. **1**. FIG. **2** shows the lower structure **3** on a left side of the vehicle body **2**. The vehicle body **2** is symmetrical in the left-right direction, and the lower structure **3** on a right side of the vehicle body **2** has a same structure as that of FIG. **2**. Accordingly, a description of the lower structure of the right side of the vehicle body **2** will be omitted.

As aforementioned, the power supply package **40** is fixed to the rockers **10** via the EA members **20** (energy absorbing members **20**). The power supply package **40** is fixed to the rocker **10** via the EA member **20** on each of a right lower part and a left lower part of the vehicle body.

The power supply package **40** comprises a lower cover **41**, an upper cover **42**, and a plurality of battery cells **43**. A container is constituted by the lower cover **41** and the upper cover **42**, and the plurality of battery cells **43** is housed within the container. The lower cover **41** comprises a flange **41***a* and the upper cover **42** comprises a flange **42***a*. The lower cover **41** and the upper cover **42** are joined to each other at the flanges **41***a*, **42***a*.

The rocker **10** is constituted of an inner rocker panel **11** and an outer rocker panel **12**. A flange **11***a* extends downward from a lower edge of the inner rocker panel **11**, and a flange **12***a* extends downward from a lower edge of the outer rocker panel **12**. A flange surface of the flange **11***a* is welded to a flange surface of the flange **12***a*. A flange **11***b* extends upward from an upper edge of the inner rocker panel **11**, and a flange **12***b* extends upward from an upper edge of the outer rocker panel **12**. A flange surface of the flange **11***b* is welded to a flange surface of the flange **12***b*.

Each of the rockers **10** has a hollow, cornered, and tubular shape extending along a front-rear direction of the vehicle body. A nut **94** is fixed to an inner side of a bottom plate **13** of the inner rocker panel **11**. The nut **94** is welded to the inner rocker panel **11** before the inner rocker panel **11** and the outer rocker panel **12** are welded to each other. A plurality of drain holes **14** is provided in the bottom plate **13** of the inner rocker panel **11**. The drain holes **14** penetrate the bottom plate **13**. The drain holes **14** will be described later.

The EA member **20** is constituted of an EA member **21** and an EA member **31**. The EA member **21** is disposed under the inner rocker panel **11**. The EA member **31** is disposed adjacent to the EA member **21** on a vehicle body center side. A flange **22** extends from an upper end of the EA member **21** toward a center of the vehicle body. The EA member **31** is fixed to the flange **22** of the EA member **21** by a bolt **91** and a nut **92**. The EA member **20** (the EA members **21**, **31**) has a hollow, cornered and tubular shape. In other words, the EA member **20** (the EA members **21**, **31**) is a hollow beam.

The power supply package **40** is fixed to a side plate **24** of each of the EA members **20** on the vehicle body center side (center side in the vehicle-width direction). In other words, the power supply package **40** is disposed between the pair of EA members **20** (pair of rockers **10**). Each of the EA members **20** (EA members **21**) is fastened to the bottom plate **13** of its corresponding rocker **10** (inner rocker panel **1**) by a bolt **93** and the nut **94**.

On each of the left and right lower parts of the vehicle body **2**, the EA member **21** and the EA member **31** are connected to each other by plural bolts (including the bolt **91**) aligned along the front-rear direction of the vehicle body, and the EA member **21** and the rocker **10** are connected to each other by plural bolts (including the bolt **93**) aligned along the front-rear direction of the vehicle body.

The floor panel **50** covers the power supply package **40** and a part of each EA member **20** on the vehicle center side. A remaining part of each EA member **20** is located under the rocker **10**. The floor panel **50** is fixed to the rockers **10** (rocker inner panel **11**).

The vehicle body **2** comprises an EA member **39** in addition to the EA member **20**. The EA member **39** is disposed outside of the EA member **20** in the vehicle-width direction. The EA member **39** is opposed to the EA member **20** with the lower flanges **11***a*, **12***a* of the inner rocker panel **11** and the outer rocker panel **12** interposed therebetween. The EA member **39** also has a hollow, cornered and tubular shape, similar to the EA member **20**. The EA members **20**, **39** are configured to absorb collision energy upon the vehicle colliding at its lateral side, and protect the power supply package **40**.

The EA members **20**, **39** are configured to absorb collision energy by collapsing in the vehicle-width direction by an impact of the collision. Although the rocker **10** contribute to the absorption of the collision energy, the rocker **10** alone is insufficient to absorb the collision energy all on their own. To address this, the hollow EA members **20**, **39** are disposed along the rocker **10**. The two EA members **20**, **39** are implemented in order to secure a width of the EA members in the vehicle-width direction by avoiding the lower flanges of the inner rocker panel **11** and the outer rocker panel **12**.

Strengths of the EA members **20** and **39** are determined in advance by a simulation, for example, such that the members can effectively absorb the collision energy. The strengths of the EA members **20** and **39** are set lower than at least a strength of the power supply package **40**.

The cross section of the EA members **20**, **39** perpendicular to the front-rear direction has a same shape at any position along the front-rear direction. The EA members **20**, **39** are made by an extrusion molding method of a metal (typically aluminum).

The drain holes **14** provided in the bottom plate **13** of the rocker **10** (inner rocker panel **11**) will be described. The rocker **10** is hollow, thus water may enter inside the rocker **10**. The drain holes **14** are provided to drain the water inside the rocker **10** to outside thereof. A bold arrow W shown in FIG. **2** indicates how the water is drained (drain passage of water).

A side surface **23** of the EA member **20** that faces outward in the vehicle-width direction is constituted of an inclined side surface **23***a* on the upper side and a perpendicular side surface lower part **23***b* on the lower side. The side surface

lower part **23***b* is continuous with a lower end of the inclined side surface **23***a*. The inclined side surface **23***a* faces diagonally upward and outward in the vehicle-width direction. The drain holes **14** are located above the inclined side surface **23***a* of the EA member **20** in a perpendicular direction. Further, a gap Ga is provided between the EA member **20** and the EA member **39**. According to the aforementioned structure, the water that has been drained from the drain holes **14** flows along the inclined side surface **23***a* and the perpendicular side surface lower part **23***b*, and drips off underneath the vehicle body. Due to this, the water that has been drained from the rocker **10** does not stay on the EA member **20**.

The plural drain holes **14** are aligned along the front-rear direction of the vehicle body, and all the drain holes **14** are disposed above the side surface **23** (inclined side surface **23***a* facing diagonally upward) of the EA member **20** in the perpendicular direction.

(Second Embodiment) FIG. **3** shows a cross-sectional view of a vehicle body lower structure **103** according to a second embodiment. FIG. **3** shows a lower structure of a left side of a vehicle body. The vehicle body lower structure **103** of the second embodiment is also symmetrical in a left-right direction (vehicle-width direction) as was the vehicle body lower structure of the first embodiment, and each of EA members **20** in a pair is fixed to a corresponding one of rockers **110**, and a power supply package **40** is disposed between the pair of EA members **20**. Hereinbelow, the vehicle body lower structure **103**, which is the lower left part of the vehicle body, will be described with reference to FIG. **3**.

In the vehicle body lower structure **103** of the second embodiment, a structure of an inner rocker panel **111** is different from that of the inner rocker panel **11** in the vehicle body lower structure **3** of the first embodiment. Except for the inner rocker panel, remaining structures in the vehicle body lower structure **103** of the second embodiment are the same as those of the vehicle body lower structure **3** of the first embodiment. In FIG. **3**, illustrations of an outer rocker panel **12** of the rocker **110** and an EA member **39** are omitted.

The inner rocker panel **111** comprises a flange **111***a* extending downward from an edge of a bottom plate **113**. The flange **111***a* is joined to a lower flange **12***a* (see FIG. **2**) of the outer rocker panel **12** (not shown in FIG. **3**). The flange **111***a* is provided with grooves **114** extending from an upper end to a lower end of the flange **111***a*. The flange **111***a* is provided with the plural grooves **114** so as to be aligned along the front-rear direction of the vehicle body. When the inner rocker panel **111** and the outer rocker panel **12** (not shown in FIG. **3**) have been joined, the grooves **114** will face the flange **12***a* (see FIG. **2**) of the outer rocker panel **12** and constitute drain holes penetrating the bottom plate **113**. Hereinbelow, the grooves **114** may be called drain holes **114**.

Along the perpendicular direction, the grooves **114** (drain holes) are located above a side surface **23** (inclined side surface **23***a*) of the EA member **20** on the outer side in the vehicle-width direction. The inclined side surface **23***a* faces diagonally upward and outward in the vehicle-width direction, similar to the first embodiment. A lower part of the side surface **23** (side surface lower part **23***b*) is continuous with a lower end of the inclined side surface **23***a*, and extends in the perpendicular direction. As a bold arrow W indicates, water inside the rocker **110** flows down through the grooves **114** (drain holes **114**) and is guided underneath the vehicle body along the side surface **23** of the EA member **20** (the inclined side surface **23***a* and the side surface lower part **23***b*). In the vehicle body lower structure **103** also, the water drained from the rocker **110** through the grooves **114** (drain holes **114**) does not remain on the EA member **20**.

A width L**1** at an upper end of each groove **114** (drain hole **114**) is wider than a width L**2** of a lower end of each groove **114**. The width of each groove **114** (drain hole **114**) is narrowed from the upper end toward the lower end. In other words, the width of each groove **114** (drain hole **114**) is narrowed toward a lower side. According to such a shape, the water easily flows downward from within the rocker **110**, while it is difficult for the water to enter from under the rocker **110** into the rocker **110**.

(Third Embodiment) FIG. **4** shows a cross-sectional view of a vehicle body lower structure **203** according to a third embodiment. FIG. **4** shows a lower structure of a left part of a vehicle body. The vehicle body lower structure **203** of the third embodiment is also symmetrical in the left-right direction (vehicle-width direction) as was the vehicle body lower structure **3** of the first embodiment, and each of EA members **220** in a pair is fixed to a corresponding one of rockers **210**, and a power supply package **40** is disposed between the pair of EA members **220**. Hereinbelow, the vehicle body lower structure **203**, which is the lower left part of the vehicle body, will be described with reference to FIG. **4**.

In the vehicle body lower structure **203** of the third embodiment, structures of an inner rocker panel **211**, an outer rocker panel **212**, and an EA member **221** are different from those of the inner rocker panel **11**, the outer rocker panel **12**, and the EA member **21** of the vehicle body lower structure **3** of the first embodiment. Further, the vehicle body lower structure **203** of the third embodiment does not comprise the EA member **39** of FIG. **1**.

Unlike the inner rocker panel **11** of the first embodiment, the inner rocker panel **211** does not comprise any drain holes. Instead of this, a lower flange **212***a* of the outer rocker panel **212** is provided with grooves **214**. Hereinbelow, the grooves **214** correspond to drain holes. The grooves **214** may be called drain holes **214**.

The inner rocker panel **211** comprises a flange **211***a* extending downward from an edge of a bottom plate **213**, and the outer rocker panel **212** comprises the flange **212***a* extending downward from an edge of a bottom plate **219**. The flange **211***a* and the flange **212***a* are joined to each other, by which the rocker **210**, which is hollow, is obtained.

The grooves **214** extend from an upper end to a lower end of the flange **212***a* of the outer rocker panel **212**. The flange **212***a* is provided with the plural grooves **214** such that the grooves **214** are aligned along the front-rear direction of the vehicle body. When the flange **211***a* of the inner rocker panel **211** and the flange **212***a* of the outer rocker panel **212** are joined to each other, the grooves **214** constitute the drain holes **214** penetrating the bottom plate **219**.

In the perpendicular direction, the grooves **214** (drain holes) are located above an inclined side surface **223** of the EA member **220** (EA member **221**) on the outer side in the vehicle-width direction. The inclined side surface **223** faces diagonally upward and outward in the vehicle-width direction. The grooves **214** (drain holes **214**) are disposed to overlap the inclined side surface **223** in the perpendicular direction. As a bold arrow W indicates, water inside the rocker **210** flows down through the grooves **214** (drain holes **214**), and is guided underneath the vehicle body along the inclined side surface **223** of the EA member **220**. In the vehicle body lower structure **203** also, the water drained from the rocker **210** through the grooves **214** (drain holes **214**) does not remain on the EA member **220**.

A width of an upper end of each groove **214** (drain hole **214**) is wider than a width of a lower end of each groove **214** (drain hole **214**). That is, each groove **214** (drain hole **214**) is narrowed toward a lower side. Such a shape makes it easier for the water to be drained downward from within the rocker **210** and difficult for the water to enter the rocker **210** from under the rocker **210**.

Points to be noted with regard to the art described in the embodiment will be described. The EA members in the second and third embodiments may also be hollow beams and may be made by an extrusion molding method of a metal (typically aluminum).

The power supply package **40** of the vehicle body lower structure of the embodiment houses batteries therein. The power supply package **40** may be a device which houses fuel cells therein.

While specific examples of the present disclosure have been described above in detail, these examples are merely illustrative and place no limitation on the scope of the patent claims. The technology described in the patent claims also encompasses various changes and modifications to the specific examples described above. The technical elements explained in the present description or drawings provide technical utility either independently or through various combinations. The present disclosure is not limited to the combinations described at the time the claims are filed. Further, the purpose of the examples illustrated by the present description or drawings is to satisfy multiple objectives simultaneously, and satisfying any one of those objectives gives technical utility to the present disclosure.

What is claimed is:

1. A vehicle body lower structure comprising:

a rocker arranged at a lower lateral part of a vehicle body and extending along a front-rear direction of the vehicle body, the rocker being hollow;

a power supply package arranged under a floor panel of the vehicle body; and

an energy absorbing member fixed to the power supply package and fixed to a bottom plate of the rocker;

wherein

a side surface of the energy absorbing member located under the rocker is inclined to face diagonally upward, and

a drain hole is arranged in the bottom plate at a position above the side surface.

2. The vehicle body lower structure of claim **1**, wherein the rocker comprises a rocker inner panel and a rocker outer panel both extending along the front-rear direction, and

the rocker inner panel and the rocker outer panel each include a flange extending downward, the flange of the rocker inner panel and the flange of the rocker outer panel being joined to each other with the flanges facing each other, and

at least one of the flanges of the rocker inner panel and the rocker outer panel comprises a groove extending in an up-down direction, the groove corresponding to the drain hole.

3. The vehicle body lower structure of claim **2**, wherein a width of the groove is narrowed toward a lower side.

4. The vehicle body lower structure of claim **1**, wherein the energy absorbing member is a hollow beam.

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